CHAPTER 6

PIPING, VALVES, AND APPURTENANCES

6-1. Pipe materials, fittings, and joints.

a. General. The major factors to be considered in the selection of pipe materials and piping systems for mobilization:

- Availability of pipe in required sizes, strengths, etc.
- Availability of fittings, connections, and adapters.
- Ease of handling and installation.
- Physical strength and pressure ratings.
- Flow characteristics or friction coefficient.
- Joint watertightness.
- Resistance to acids, alkalis, high temperature or corrosive wastes and corrosive soils.

b. Ductile iron. Ductile iron (D.I.) pipe is suitable for force mains used at pumping stations and wastewater treatment facilities. Special uses include river crossings, pipe located in unstable soils, highway and rail crossings, and pipe installed above ground. D.I. pipe is susceptible to corrosion from acid wastes and aggressive soils. Cement linings, bituminous coatings, or polyethylene linings are usually provided for interior protection. Exterior bituminous coatings are standard, and for extremely corrosive soils, a polyethylene encasement may be required. Pipe is available in 3-inch through 54-inch diameter and with mechanical, push-on, or flanged joints. Flanged joints are restricted to interior piping.

c. Steel. Steel pipe may be used for force mains when lined with cement mortar or bituminous materials to provide internal protection. A bituminous coating must be applied for external protection also. Lined and coated steel pipe is available in diameters 6-inch through 144-inch. Galvanized steel pipe will be used for small diameter force mains and pressure sewers from 1-1/4 inch to 4-inch in size. Joints for steel pipe less than 6-inch will be threaded. Pipe 6-inch in diameter and larger will have mechanical, push-on, or flanged joints. Threaded and flanged joints will be used only for interior piping where 6-inch and larger diameter pipe is required.

d. Concrete. Concrete pressure pipe will generally be used where high strength or large diameter force mains are required. Pretensioned reinforced concrete pressure pipe is available in diameters 10-inch

through 42-inch, prestressed concrete pressure pipe in diameters 16-inch through 144-inch, and reinforced concrete pressure pipe in diameters 24-inch through 144-inch. Each type utilizes bell and spigot joints with rubber gaskets.

e. Asbestos-cement. Force mains constructed of asbestos-cement (A.C.) pressure pipe are durable and light in weight. However, A.C. pipe is affected by corrosive wastes and aggressive soils and must be provided with plastic linings for protection. Pipe is available in diameters 4-inch through 42-inch and will be joined by means of couplings utilizing rubber gaskets.

f. Plastic. Characteristics which make plastic pipe highly desirable for force main use include high corrosion resistance, light weight, and low coefficient of friction. Disadvantages include possible pipe wall deflections when installed improperly or subjected to high temperature wastes. Chemical breakdown caused by prolonged exposure to sunlight is also a disadvantage with plastic pipe. The following types of plastic pipe are suitable for use.

(1) Polyvinyl chloride (PVC). PVC pipe is available in diameters 4-inch through 12-inch and with push-on or solvent weld joints.

(2) Polyethylene (PE). PE pipe may be used in diameters 1-1/2 inch through 48-inch. Pipe joints consist of mechanical, flanged, or heat fusion types.

(3) Polypropylene (PP). Pipe diameters available with polypropylene pipe are 1-1/2 inch through 4-inch. All pipe will be joined by heat fusion methods.

g. Fiberglass. Fiberglass pipe provides a good alternative for use in large diameter force mains. High structural integrity, low pipe friction coefficient, and a high resistance to internal/external corrosion in addition to high temperature wastes, are important properties of fiberglass pipe. The following types of fiberglass pipe may be used.

(1) Reinforced thermosetting resin pipe (RTRP). RTRP pipe may be installed in diameters of 6-inch through 144-inch. Jointing systems for RTRP pipe include ball and spigot, flanged, or special mechanical type couplings. Elastomeric gaskets are used to provide flexible joints.

(2) Reinforced plastic mortar pipe (RPMP). Pipe diameters available for RPMP pipe range from 8-inch to 144-inch. Pipe joints are made with grooved couplings or ball and spigot joints utilizing rubber gaskets.

h. Interior piping. Pump suction and discharge piping inside the station will normally be ductile iron or steel. However, other pipe materials covered in this paragraph are not precluded from use. Pipe, fittings, and joints serving as force mains will be selected to withstand the maximum internal operating pressures including transient surges. The project specifications will indicate the appropriate pressure class and rating for each pipe application.

6-2. Valves and appurtenances. The use of valves in wastewater pumping applications can be divided into the following categories.

a. Isolation or shutoff valves. Where there is the need to isolate parts of the piping system, manual shutoff valves will be used. Gate valves or butterfly valves generally serve as shutoff valves, however, ball valves or plug valves may also be used. Shutoff valves are required on the suction and discharge sides of all pumps.

b. Surge control valves. To protect pumps and piping from surges, gravity operated swing check or ball check valves, or automatically operated ball, plug, butterfly, or pinch valves will be installed in the pump discharge line.

c. Blowoff valves. A valved outlet installed at the low point in a force main and arranged to drain or flush the pipeline is termed a blowoff. Normally, blowoffs will be required only on long depressed sections of force main, or where an accumulation of solids is likely to occur. Blowoff connections will be installed in manholes or valve structures and will be protected against freezing.

d. Air valves. Air valves will be installed at high points in force mains for the purpose of admitting and releasing air. When the pipeline is taken out of service for draining, flushing, and filling operations, a manually operated valve will be adequate. However, where air pockets or pressures less than atmospheric are likely to occur with the pipeline in service and under pressure, automatic air release and/or air vacuum valves will be used. All valves will be installed in a manhole or valve structure with adequate drainage and protection against freezing.

6-3. Installation.

a. Structural design. Structural design of force mains will be in accordance with the requirements for sewers set forth in chapter 5 of EM 1110-3-174.

b. Anchorage. Force mains will be anchored to resist thrusts that develop at bends or branch connections, and plugs in the pipe. The magnitude of such forces can be calculated with the use of formulas found in the detailed discussion of thrust block design given in

EM 1110-3-164. Required anchorage will consist of tie rods and clamps or concrete thrust blocks.

c. Depth of cover. Force mains will be installed with sufficient depth to prevent freezing and to protect the pipe from structural damage. A minimum cover depth of 3 feet will ordinarily be required for freeze protection. However, in unusually cold climates, a greater depth may be required.

d. Protection of water supplies. Force mains and pressure sewers will not be installed closer than 10 feet horizontally to potable water lines. If conditions prevent a 10 foot clearance, a minimum distance of 6 feet will be allowed, provided the bottom of the water pipe is at least 12 inches above the top of the pressure pipe. Where a pressure pipe must cross a potable water line, the pressure line will always be installed below the water line with a minimum vertical clearance of 2 feet.